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DRAWINGS ATTACHED

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(54) IMPROVEMENTS IN OR RELATING TO ADVANCING MINE ROOF SUPPORTS

(71) We, GULLICK DOBSON LIMITED, a British Company of Ince, Wigan, Lancashire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention concerns a self-advancing mine roof support.

Such a self-advancing mine roof support can be connected by one or more advancing rams to a face conveyor. The advancing ram is for pulling the support towards the face conveyor. For pushing forward the face conveyor, either additional rams are mounted on the supports which can be pulled forward and can then serve as abutments for the additional rams or the advancing rams of the supports can be double-acting and serve alternately for pulling the supports forward and for the advance of the face conveyor.

Alternatively such a self-advancing support can be made as a so-called walking support which consists of two units which can be advanced in the direction of the face advance, relative to each other, with the help of an advancing ram. Each unit serves the other alternately as an abutment. To advance the face conveyor, either additional rams are used or the face conveyor is pushed against the face by the advance of one or both units.

Under certain mining conditions it may be necessary to displace the face conveyor and the supports not only towards the face but also along the face. This can be the case, for example, when the face conveyor slips downhill relative to a line of supports in inclined faces or when the entire face is to make a swivel- or correcting-movement during mining, e.g. in order to move round a safety pillar or a geological fault. Movements of the face conveyor along the face are also necessary when the face, in order to avoid safety pillars or geological faults, is not at a right angle to the roadways. In this case it is necessary to remove supports and sections of the conveyor from one end and to install them again at the other end of the face.

The invention aims at improving the supports of the above-mentioned kinds.

The present invention provides a self-advancing mine roof support for supporting a face along which there is a face conveyor, having a displacement ram arranged to extend longitudinally of the face conveyor and between the support and the face conveyor for moving the face conveyor longitudinally of itself.

It is possible, with the help of displacement rams which extend mainly parallel to the face conveyor, to displace the face conveyor in its longitudinal direction relative to the supports serving as abutments. In standard practice heretofore, this was only possible with the help of an anchor station arranged at the head end of the face conveyor. An anchor station must be fitted with displacement elements for pulling the face conveyor longitudinally. The displacement elements have, however, to apply extremely large forces in order to be able to displace the face conveyor in one piece uphill against the friction forces which exist between the face conveyor and the floor and the weight component. Due to the extremely large displacement forces which are necessary, the flexible connections between the individual conveyor sections are stressed to such an extent, especially in the upper part of the face, that these connections frequently break. These disadvantages are minimised simply by using supports according to the invention, as each of the displacement rams moves only a short section of the conveyor. A face equipped with the supports of the invention possibly could dispense with an anchor station entirely.

Each support with a ram for longitudinal movement of the face conveyor is suitably moveable along the face to a new location rela-

[*Price 25p*]

tive to the conveyor and can be attached to the conveyor in this new location. Thus it is possible to move these supports, after each longitudinal movement of the face conveyor, in such a way, that subsequently another longitudinal movement of the conveyor can be caused.

Also, these rams preferably extend up the slope from the support end of the ram to the conveyor end of the ram thus the rams for moving the face conveyor uphill along the face are disposed with their full piston surfaces available to give greater displacement forces (if the rams were arranged to extend downhill and to draw the conveyor along the piston surface available would be reduced by the cross-section of the piston rod).

The displacement ram is preferably positively attached to both the conveyor and the support to transmit both pulling and pushing forces. This enables the support to be moved along the face by retracting the displacement ram whilst the face conveyor serves as an abutment.

Differences in height or other irregularities of the floor have to be allowed for and therefor the displacement ram is fixed both to the face conveyor and the support element with a measure of pivotal freedom.

A particular and robust adjustable connection between displacement ram and face conveyor can be achieved by attaching the displacement ram by means of a removable plug to a perforated strip fitted to the face conveyor.

A mine roof support with at least one advancing ram between the support and the face conveyor for the advance of the support and possibly for the advance of the face conveyor can have a displacement ram also arranged between the support and the face conveyor. Preferably the displacement ram is substantially perpendicular to the advancing ram when the piston rod of the advancing ram is retracted. This enables longitudinal movement of the face conveyor to occur during its advance towards the face by extending both rams simultaneously. When the support consists of a main rear unit and an auxiliary forward unit, the advancing ram is suitably connected with the rear unit and the displacement ram with the forward unit preferably on the base thereof. This arrangement of the displacement ram on the one hand and the advancing ram on the other hand is particularly compact so that in spite of the use of the additional ram, the passage-way between rear unit and forward unit is not narrowed and the forward unit can be pushed directly up to the conveyor. When the advancing ram is pivotal on the support as is often the case when the advancing ram is fixed to a rear unit, the stroke of the displacement ram is such that, when the piston rods of the rams are extended, the permitted swivel angle of the advancing ram is not exceeded.

If the support consists of two side-by-side units, it can be an advantage if the displacement ram is fixed to the uphill unit so that it will not interfere with the advance of the other unit. When the supports are however so close together that the displacement ram would prevent the neighbouring support advancing, then the ram is preferably fixed to the downhill unit of the support. This gives a particularly compact arrangement. In this case the support is advanced with one unit being brought up to the other, that is, with one unit permanently advanced relative to the other. The advanced unit will normally be the downhill one but could be the uphill one.

The cylinders of the displacement rams are connected to a pressure-supply device via control valves on the supports. For adjustment of the longitudinal movement, there is provided an adjustable metering unit which is fitted in the pressure medium supply to the displacement ram. This metering unit controls the amount of pressure medium supplied to the ram.

When a line of supports consists of supports of the invention and of conventional supports, then the supports of the invention are distributed along the face conveyor at intervals. This makes it possible that each support of the invention needs move only a short length of the face conveyor along the face.

Due to the arrangement of the self-advancing supports in accordance with the invention, and through appropriate use of the invention, there can be provided a face installation in which the sections of the face conveyor and/or the parts serving for their connection have longitudinal tensile strengths such that they can accommodate the forces present in sections between, say, three supports of the invention at a time, but not the tensile forces which would occur through moving the load of the entire face conveyor in one piece. This gives the benefit that the sections of the face conveyor or their connecting elements can be made much lighter than in the case of a face installation with an anchor station arranged only at the head end of the face conveyor.

Two embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a schematic plan view of a support in accordance with the invention in the condition where a piston rod of an advancing ram is retracted,

Figure 2 is a schematic plan view of the support shown in Figure 1 with the piston rod of the advancing ram extended,

Figure 3 is a schematic plan view of a support in accordance with the invention with a displacement ram attached to an uphill unit of the support, and

Figure 4 is a schematic plan view of a sup-

port in accordance with the invention with a displacement ram attached to a downhill unit of the support.

A support as shown in Figures 1 and 2 consists of a rear main unit 1 and a forward auxiliary unit 2. A base 3 of the main unit 1 carries four hydraulic legs 4, which support a roof bar construction which can be pressed against the roof. The roof bar construction is not shown in detail in the drawings. The base 3 of the main unit 1 is connected with a base 6 of the auxiliary unit 2 by two parallel elements 5. The elements 5 are pivotally connected both to the main unit 1 and the auxiliary unit 2.

The base 6 of the auxiliary unit 2 carries two legs 7 which support a roof bar construction (not shown) which is connected with the roof bar construction of the main unit 1 and projects to the front thereof so that the roof is supported above a face conveyor 8.

The conveyor 8 is fitted with a perforated strip 9 on its side nearer the support 1, 2. This strip serves for the fixing of a displacement ram 14. An advancing ram 10 for the advance of the support 1, 2 and possibly also for the advance of the face conveyor towards the face is connected with its cylinder part to the base 3 of the unit 1 and with its piston rod to the perforated strip 9 of the face-conveyor 8. The connection of the advancing ram 10 both at the unit 1 and at the conveyor 8 is by universal joints. The connection at the face conveyor 8 is by an adjustable plug connection 11 whose plug or pin 12 can be inserted into a desired hole of the perforated strip 9. The base 6 of the auxiliary unit 2 has — between the two legs 7 — a bridge-shaped connecting element 13, under which the piston rod of the advancing ram 10 can extend.

The base 6 of the auxiliary unit 2 is further connected with a displacement ram 14 which is approximately perpendicular to the advancing ram 10, when the piston rod thereof is retracted.

The piston rod of the displacement ram 14 is fixed to the perforated strip 9 of the face conveyor 8 by a universal joint, while the ram part is fixed also by a universal joint to the base 6 of the auxiliary unit on its face side. The stroke of the displacement ram 14 is such that when the piston rod of the advancing ram 10 is extended, it is not possible to cause the allowable swivel angle thereof to be exceeded by extending the displacement ram 14. As well as the advancing ram 10, the displacement ram 14 is also connected with the perforated strip 9 of the face conveyor by a plug connection 15, the plug or pin 16 of which can be inserted into a desired hole.

A pressure medium supply of the advancing ram 10 and the displacement ram 14 includes a control valve (not shown) on the support 1, 2. The pressure medium supply to the ram 14 also contains an adjustable metering unit (not shown), with the help of which the amount of pressure fluid for the ram 14 can be adjusted in such a way, that the conveyor 8 and the support 1, 2 can be moved by a predetermined adjustable distance.

Figure 2 shows the support shown in Figure 1 with the piston rods of the advancing ram 10 and of the ram 14 extended.

Assuming that the conveyor is to be moved uphill in the direction opposite to the direction of slope shown by arrow E, the support shown in Figures 1 and 2 operates as follows: during the advance of the conveyor 8 which is done by pressure on the full surface of the pistons of the advancing rams 10 of at least several supports present along the face, the full surface of the displacement ram 14 is acted on by pressure medium. This moves the conveyor up hill during the advance. The length of the uphill movement can be adjusted by controlling the amount of pressure medium with the help of the metering unit. After this, the plug connection 11 is disconnected by pulling out the pin 12 and is then fixed in a hole of the strip 9 more downhill. The same thing applies to plug connection 15. After that the support 1, 2 is advanced towards the conveyor 8 by pressure on the annular surface of the advancing ram 10, but it is useful to load the annular surface of the ram 14 with pressure medium as well.

Uphill movement of the support 1, 2 can be achieved by releasing support 1, 2 from its position between roof and floor and advancing it to the face conveyor 8 and by applying fluid pressure on the annular surface of the ram 14 during the advance. Subsequently the plug connections 11 and 15 can be reconnected by moving the pins 12 and 16 to suit the new position of the support 1, 2 relative to the conveyor.

The support shown in Figures 3 and 4 is a so-called walking support and consists of two units 20 and 21, which are side-by-side and can be advanced relative to each other in a direction of the face advance by an advancing ram 22.

In the case of the support shown in Figure 3, a displacement ram 24 is fixed to the base of the uphill unit 21 and extends uphilll coextensive with a part of the conveyor that is above the support 20, 21. Thus the unit 20 is not prevented from advancing by the ram 24, so that support 20, 21 can advance in leapfrog steps. The piston rod of the ram 24 is attached to a fixing element 25 on the perforated strip 9 of the face conveyor by a cotter or pin 26. The connection between the piston rod of the ram 24 is either by abutment only, to transmit pushing or pulling forces or as shown to transmit both pulling and pushing forces; this connection and the connection between the ram 24 and the base of the unit 21 is formed to allow universal pivoting movement.

In the support shown in Figure 4 the ram 24 is attached to the downhill unit 20, so that the ram 24 extends over the part of the face conveyor which lies directly in front of the support. This makes it possible for supports to be closer together without the rams 24 hindering the advance of the neighbouring supports.

Advance of the support of Figures 3 and 4 is done by alternate operation of the full — and annular-surfaces of the piston of the advancing ram 22, the two units 20, 21 serving each other alternately as an abutment. In order to move the face conveyor along the face, the ram 24 is fed with pressure medium, whilst the two units remain in their position between roof and floor and serve as an abutment. The pressure medium supply to the ram 24 is controlled by a control valve (not shown) connected to one of the units 20, 21. The extent of movement along the face can be controlled by metering the amount of pressure medium supplied.

Not all of the supports present in the face have to be fitted with a displacement ram and often it is sufficient to provide such a ram for a small number of supports which are arranged along the face at regular intervals.

WHAT WE CLAIM IS:—

1. A self-advancing mine roof support for supporting a face along which there is a face conveyor, having a displacement ram arranged to extend longitudinally of the conveyor and between the support and the face conveyor for moving the face conveyor longitudinally of itself.

2. A support according to claim 1, having at least one advancing ram arranged to extend between the support and the face conveyor to advance the support and possibly also the face conveyor, in which the displacement ram is arranged to lie between the support and the face conveyor and to extend substantially perpendicular to the advancing ram when the piston rod of the advancing ram is retracted.

3. A support according to claim 2, comprising a main rear unit and a forward auxiliary unit, in which the advancing ram is connected with the main unit and the displacement ram with the auxiliary unit.

4. A support according to claim 3, in which the displacement ram is fixed to the front of the base of the auxiliary unit.

5. A support according to claim 1, which comprises two side-by-side units which advance alternatively relative to each other, in which the displacement ram is attached to one of the units and extends away from the other unit, in use said one unit being the uphill unit.

6. A support according to claim 1, which comprises two side-by-side units which advance alternately relative to each other, in which the displacement ram is attached to one of said units and extends across the front of the other unit, in use said one unit being the downhill unit.

7. A support according to any one of claims 2 to 6 whose advancing ram is fixed to the support and can be swivelled through a limited extent and in which the stroke of the displacement ram is such that, when the piston rods of the advancing ram and the displacement ram are extended the permitted swivel angle of the advancing ram is not exceeded.

8. A support according to any one of claims 1 to 7 in which the pressure medium chambers of the displacement ram are connected with a pressure medium supply means through a control valve belonging to the support.

9. A support according to claim 8 having a metering unit fitted into the pressure medium supply means by virtue of which the movement of the displacement ram can be controlled.

10. A support according to any one of claims 1 to 9 in combination with a face conveyor, in which the support or the conveyor has means providing for the relocation of the support relative to the conveyor.

11. A support according to claim 10 in which the displacement ram is connected both with the support and the conveyor so as to transmit both pulling and pushing forces.

12. A support according to claim 11 in which the connections between the displacement ram and the conveyor and the supports allow pivotal movement.

13. A support according to any one of claims 10 to 12 in which the displacement ram is connected by a removable plug connection to a perforated strip on the face conveyor.

14. A support according to any one of the preceding claims in which the displacement ram extends in the uphill direction from the support to the conveyor.

15. A line of mine roof supports which contains supports in accordance with any one of claims 1 to 14 in which the supports according to any one of claims 1 to 14 are distributed at intervals amongst other mine roof supports over the length of the face conveyor.

16. A mine face installation having a line of mine supports according to claim 15 and a, or the, mine face conveyor in which sections of the face conveyor and/or parts serving to connect these sections are sufficiently strong in tension in the longitudinal direction of the conveyor that they can cope with stresses exerted by the displacement rams of a number of supports having such rams and spaced along the conveyor but not the stresses exerted by a single anchor station.

17. A mine roof support substantially as herein described with reference to and as illustrated in the accompanying drawings.

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1269022 COMPLETE SPECIFICATION
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Sheet 1

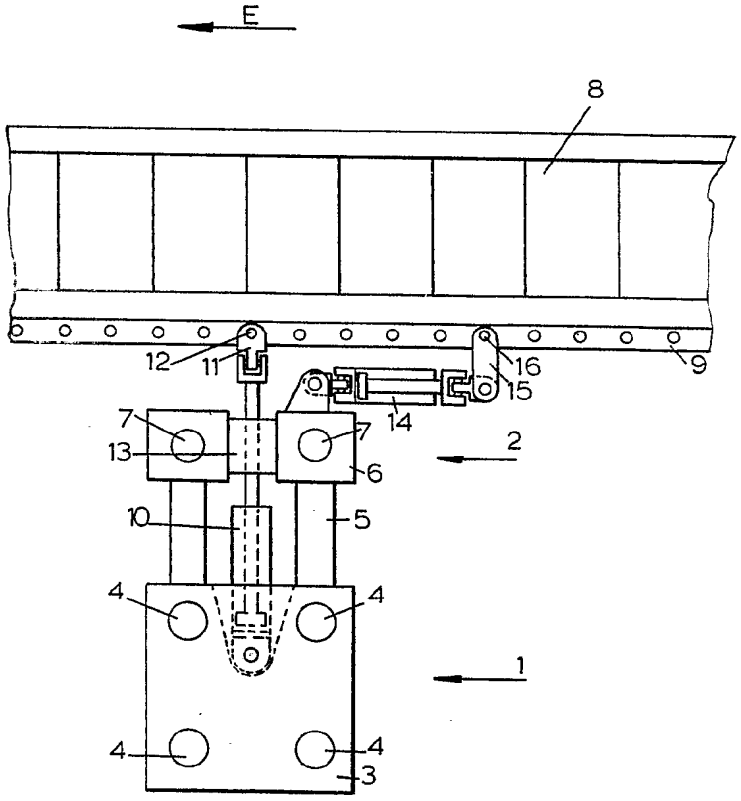

FIG. 1.

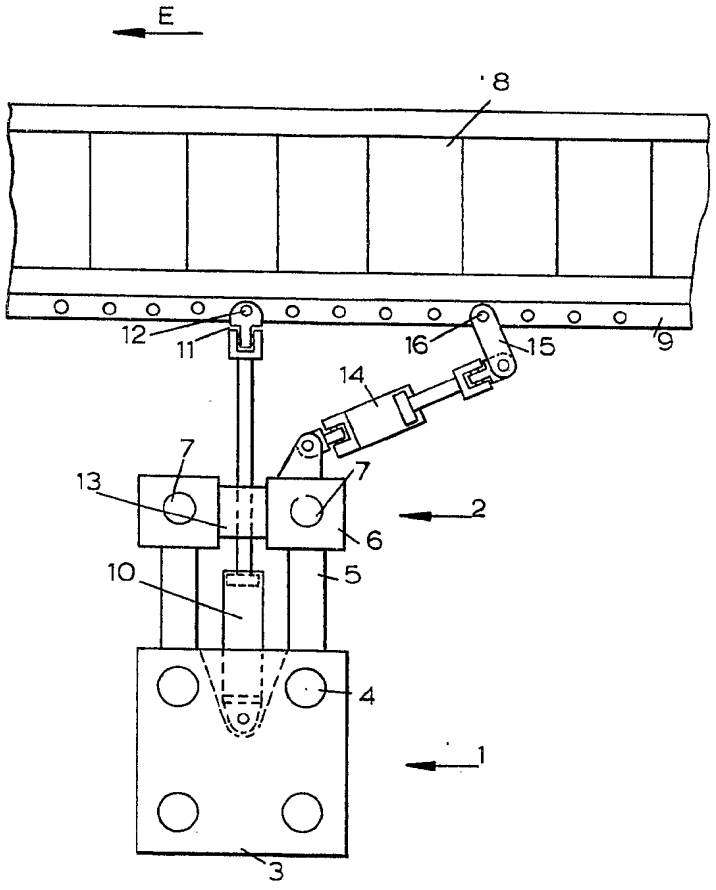

FIG. 2.

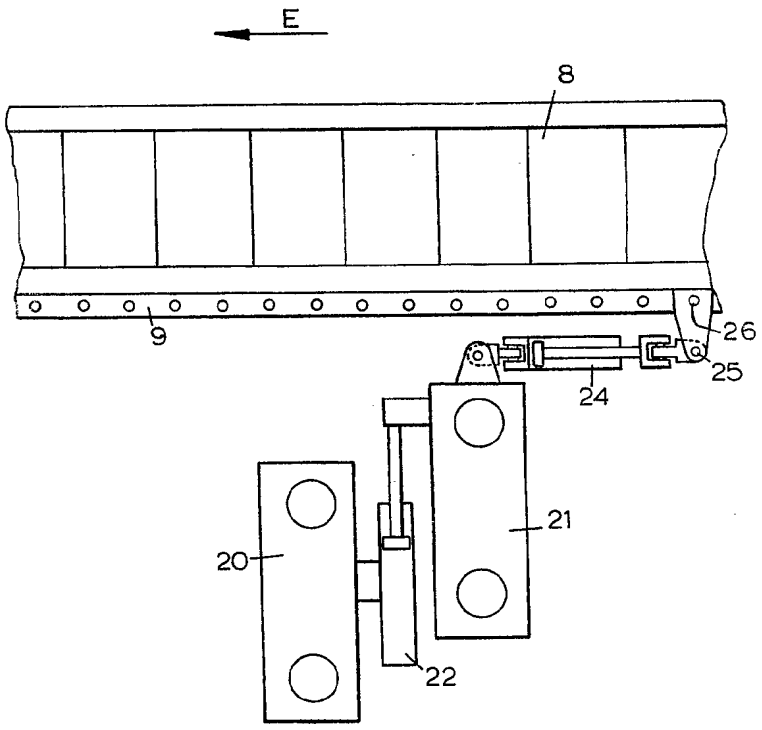

FIG. 3.

1269022 COMPLETE SPECIFICATION
4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 4

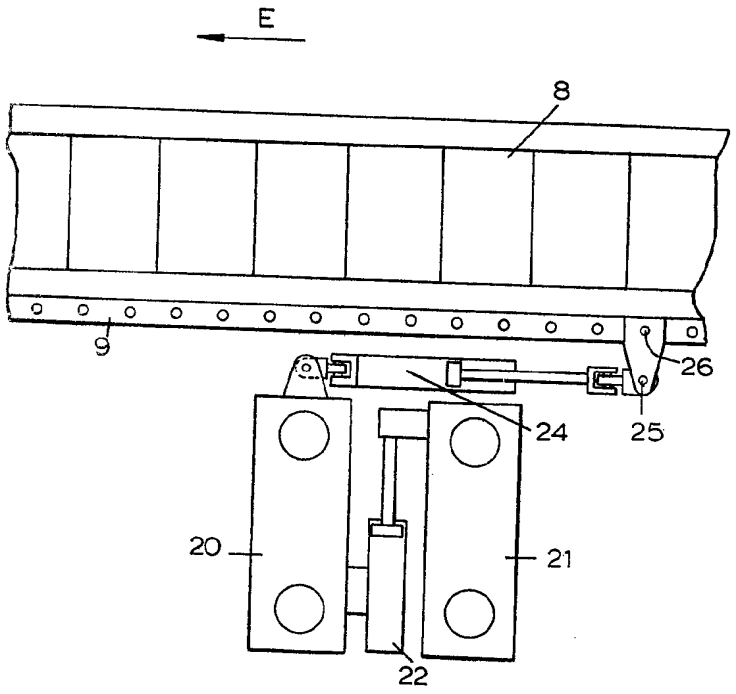

FIG. 4.